Department of Fish and Wildlife

DESIGN GUIDELINES APPROVED FOR USE IN DESIGNING WATER CROSSINGS OVER FISH-BEARING WATERS IN WASHINGTON STATE

Anadromous Salmonid Passage Facility Design[1]

Notes for appropriate use to comply with WAC 220-660-190

May 6, 2015

Anadromous Salmonid Passage Facility Design (ASPFD) covers many topics concerning fish passage. Since WAC 220-660-190 applies only to water crossings, these notes concern only Chapter 7, **Culverts and Other Stream Crossings**. The National Marine Fisheries Service (NMFS) has jurisdiction only over anadromous salmonids and the methods in ASPFD are adapted specifically for these species which are vigorous and strong-swimming. WDFW, on the other hand, protects *all* fish through RCW 55.77.030 and WAC 220-660. Despite the significant differences in swimming ability and habitat requirements between the many fish species, several of the ASPFD crossing design methods can satisfy the provisions in WAC 220-660-190.

Section 7.1

The principle of maintaining ecological function through the crossing is very similar to what is required in WAC 220-660-190(2). One exception is that ASPFD does not say that the designer should consider lateral channel movement in sizing and placement of the crossing structure where there it is likely to occur.

Section 7.2

Under certain circumstances, NMFS will require that crossings allow physical processes that include the stream-*floodplain* corridor. While ASPFD does not specifically say lateral channel movement, it is clear that processes outside the channel should be considered in design.

The prioritized list of alternatives is similar to what WDFW would recommend. Alternatives 4, 5, and 6 are covered under WAC 220-660-200, Fish Passage Improvement Structures.

[1] Nordlund, B. (2011). Anadromous salmonid passage facility design. National Marine Fisheries Service Northwest Region: 37 pgs.

Section 7.3

The Embedded Pipe Design Method is very similar to the No-Slope culvert design method in WAC 220-660-190(6)b and could be used interchangeably. For a more detailed description of this method please see the **Water Crossing Design Guidelines[2] (WCDG)**.

Section 7.4

The intent and purpose of the Streambed Simulation Design Method is the same as the WDFW Stream Simulation Design Method (WAC 22-660-190(6)a and the **WCDG** Chapter 3).

Section 7.4.2.1

For channels that are "not fully entrenched" the minimum culvert bed width is 1.3 times the bankfull width. For a 15 ft BFW, this results in a 19.5 ft bed width culvert. The WDFW equation for culvert bed width is 1.2(BFW) + 2 ft. For a 15 ft BFW stream the culvert bed with is 20 ft, which is essentially the same as the ASPFD equation. For smaller streams the ASPFD equations results in a smaller size than the WDFW equation (the minimum bed width is nominally 6 ft). But, in Section 7.4.2.2 the minimum vertical clearance is 6 ft and in Section 7.4.2.4 the minimum embedment is 3 ft. Both these requirements force the smallest pipe to have a rise of 9 ft. Round pipes would have a minimum 9 ft diameter, but box culverts could have a width of 1.3BFW and a rise of 9 ft. A fish bearing stream with a BFW of 3 ft would require 1.3*3 ft = 4 ft span x 9 ft rise box culvert. For constructability reasons alone, WDFW would suggest that wider culvert with a shorter rise would be more reasonable.

Section 7.5

The hydraulic design method is covered under WAC 220-660-200 Fish Passage Improvement Structures. Sections 7.5 and 7.6 can be used to design this type of structure, although WDFW recommends that the designer be familiar with Chapter 200 since the criteria listed there are not optional, as they are Chapter 190, and compliance will be required in order to obtain an HPA.

[2] Barnard RJ, Johnson J, Brooks P, Bates KM, Heiner B, Klavas JP, Ponder DC, Smith PD, Powers PD. 2013. Water Crossings Design Guidelines. Washington Department of Fish and Wildlife: Olympia, Washington.